RESEARCH COMMUNICATION

Video-Assisted Thoracoscopic Surgery for Malignant Pleural Effusions

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Abstract

Aim: To evaluate the efficacy of video-assisted thoracoscopic surgery (VATS) in the diagnosis and treatment of malignant pleural effusions (MPE) and to assess the results and complications of the procedure. Methods: A total of 61 patients with the diagnosis of malignant pleural effusion were assessed retrospectively between 2004 - 2010, 25 women (40.9%) and 36 men (59.1%), with an age range of 18-78 (mean: 61.3). Video-thoracoscopic surgery was performed under general anesthesia or with local anesthesia in sedated patients. Results: No intraoperative complications were observed. In 6 cases, prolonged air leak developed. Pleurodesis was successfully implemented in malignant cases. The chest tube was removed when the amount of fluid was less 50cc/24h. The duration of drainage was significantly shorter in patients in whom VATS was performed. Conclusion: We believe that VATS is an effective method in the diagnosis and palliative treatment of cases with malignant pleural effusions.

Keywords: Video - thoracoscopic surgery - pleurodesis - malignant pleural effusion

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Introduction

Malignant pleural effusion is a clinical entity which develops in advanced stages of various malignancies and is diagnosed by determination of exfoliated malignant cells in pleural fluid. Fluids appearing due to a known malignancy with no malignant cells in pleural fluid are described as para-malignant pleural effusions. The diagnosis of MPE is associated with a poor prognosis. MPE may be the first indicator of a malignancy or the first sign of a tumor with metastasis (Sahn, 1997). Carcinoma of any organ may also cause metastasis in the pleura. In the literature, 75% of MPEs are shown to be due to lung cancers (30%), breast cancers (25%) and lymphomas (20%), in respective order of decreasing frequency. Ovarian carcinoma is responsible for 6%, and sarcoma and malignant melanoma are responsible for 3% of the cases. In 6-7% of MPE cases, the primary tumor may not be diagnosed (Sahn, 1997; Light, 2001).

The most frequently indicated source of development of malignant effusions is the increase in capillary permeability of pleura due to metastatic disease. Lymphatic obstruction is the second most important mechanism playing a role in the development of malignant effusion. Involvement of mediastinal lymph nodules causes fluid accumulation by disrupting the lymphatic clearance (Light, 2001; Sahn, 1998).

Currently, as a minimally invasive surgical intervention, VATS has important advantages such as causing less surgical trauma, decrease in postoperative pain and lower requirement for analgesics and narcotic agents. It is a more protective intervention in terms of respiratory functions. The most important criteria in VATS is selection of appropriate patients (Lin et al., 2000).

In our trial, we intended to evaluate the diagnostic and therapeutic intervention with VATS together with the results of the procedure.

Materials and Methods

We intended to retrospectively evaluate 61 VATS cases and the results of the procedure among 158 patients who had presented to the Departments of Thoracic Surgery of YYU Medical Faculty Hospital and the Van Training and Research Hospital with symptoms of pleural effusion between 2004-2010. Thirty six of our cases (59.1%) were men and 25 (40.9%) were women. The age range was 18-78 with a mean age of 61.3.

Evaluations like routine examinations, computerized tomography of the thorax, and pleural fluid analysis were performed in the preoperative period. Accumulation of fluid was located on the right in 39 cases (61.8%). In 5 cases (7.9%), bilateral fluid accumulation was determined. Left MPE was diagnosed in 17 cases (27.8%). Of bilateral MPE cases, 3 patients had breast cancer and in 2 cases, ovarian tumor was diagnosed.

Patients whose general health condition was severely disturbed, those who could not tolerate VATS, and cases with expected survival of less than one month were excluded from the trial. Conservative methods such as

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repetitive thoracentesis and tube thoracostomy were performed in these patients. In 16 cases (25%) who had presented with MPE and massive fluid (which completely filled one hemithorax and pushed the mediastinum aside), immediate tube thoracostomy was performed due to severe difficulty in respiration. These patients were prepared for VATS after their respiratory disturbance was restored.

In 11 cases (18.3%), the patients were sedated and the procedure was performed under local anesthesia. These were patients who were determined as high-risk cases in terms of anesthesia upon consultation with the department of anesthesia. General anesthesia was avoided in these patients due to concurrent diseases (COPD and cardiac problems). Among cases in whom general anesthesia was administered, double lumen endotracheal intubation was performed in 35 patients (55%) and the intervention was performed using a large endotracheal tube in the remaining 15 cases (24%). In these 15 cases, double lumen intubation was not placed due to technical problems in the department of anesthesia and due to unavailability of this tube during the surgical operation. In all cases, the patients were placed in the standard posterolateral thoracotomy position; initially, thoracentesis was performed to determine the most appropriate localization for drainage of fluid, followed by incision and installment of the first port. In most cases, this was at the mid-axillary line, at the localization of the 7th rib bed. In patients for whom this localization was inappropriate, the 5th or 6th intercostal spaces were chosen. Upon entering the thorax through this port, evaluation of the fluid status, adhesions, pleural nodularity, thickening and mass localization was performed. The procedure was performed, with an attempt to be as minimally invasive as possible and fluid was removed through this single port to evaluate the lungs and the pleural cavity. In 18 of our cases (29.5.9%), intervention was possible through a single port. A considerable number of our cases were patients who exhibited septations and adhesions with insufficient intervention area, being 33 cases (54%). In these patients, the intervention was performed through 2 ports by separating septations, fluid loculations and pleural adhesions. In 10 patients (16.3%) with advanced adhesions, 3 ports were used. In 6 of these 10 cases (9.8%), an appropriate intervention was not possible by VATS; therefore, the incision was progressed to thoracotomy to perform pleurectomy, biopsy and pleurodesis, and in 1 patient with mesothelioma, pleuro-pneumonectomy was performed. In VATS cases, upon releasing of the lung and the pleural adhesions, full expansion of the lungs was provided through double lumen intubation tube to ventilate the surgical side by working in coordination with the anesthesia specialist. Following this intervention, the lungs were collapsed again and chemical pleurodesis was performed using the following agents: in 45 cases (75%), 3 gr of sterile talc containing no asbestos in Mediflex 250 cc, in 9 patients (14%) liquid tetracycline 5 mg/kg in physiological saline of 100cc, and in 6 cases (9.8%) 60 IU bleomycine in physiological saline of 100cc. Insufflation and homogenous dispersion of these chemical agents in all pleural areas were provided by the thoracoscope. Upon final controls with the thoracoscope, a chest tube no. 32 was inserted through an appropriate port and the procedure was completed. In order to prevent pulmonary oedema, prednisolone 80 mg and furosemide 20 mg were administered in all patients (while pleural fluid was drained). Post-intervention follow-up was provided by control chest X-Rays.

The chest tube was removed when the daily amount of drainage was ≤ 50 cc and following evaluation of the control chest X-Ray on the following day, the patients were discharged.

Results

The main symptom in patients in whom VATS was performed due to MPE was dyspnea. This was observed in 49 patients (77%). Pain was the second most important symptom and this was observed in 33 cases (50%). Fluid was bilateral in 5 of the 61 cases. In 2 of these patients, bilateral tube thoracostomy was performed initially due to massive fluid accumulation and in separate sessions, VATS and bilateral chemical pleurodesis was performed. In the remaining 3 cases, VATS was performed in separate sessions under sedative anesthesia and pleurodesis was performed. Among the MPE patients, 41 (67.2%) cases had previously been diagnosed with malignancy. In 12 of these patients (19.6%), MPE was diagnosed by cytological examination of thoracentesis fluid in the clinic; in the remaining 29 patients (47.55), the diagnosis was established by pleurectomy and lung biopsy through VATS intervention. In cases who had previously been diagnosed by thoracentesis before VATS application, the diagnosis was further confirmed by pleural and parenchymal tissue examinations.

In 20 patients (32.7%) with no previous diagnosis of malignancy, the diagnosis was reported as lymphoma after VATS intervention. These 6 cases were referred to the hematology-oncology departments after discharge. Following the intervention, non-small cell lung Ca was reported in 8 patients. These patients were referred to medical oncology-radiation oncology departments after discharge. Palliative treatment was provided in 2 of 3 inoperable cases diagnosed with mesothelioma, and pleuro-pneumonectomy was performed in one patient who was evaluated as resectable during exploration. This patient was regularly followed-up for three years.

Fourteen of the patients who had been diagnosed and treated for MPE were patients who had previously been operated in our department. Nine of these patients were operated with a diagnosis of oesophagial Ca and 5 patients were operated for lung Ca.

In our trial, the most frequent reason for MPE was lung cancer (16 cases, 26.2%). The second most frequent cause was GIS malignancies, in contrast to findings in the literature. We associated this finding with the fact that our region is an endemic area in terms of oesophageal-gastric cancers (Table1).

In a total of 6 patients (9.5%), parenchymal injury and related prolonged air leak developed following VATS intervention. In 4 of these patients who had been followed-up after VATS, the leak was persistent; therefore, immediate thoracotomy was performed to restore the

Table 1. Types of Malignancies Oserved in Cases

Type of Malignancy	n	Ratio(%)
Non-Small Cell Lung Cancer	16	26.2
Gastrointestinal System Cancer	12	19.6
Breast Cancer	11	18.3
Lymphoma	7	11.4
Small-Cell Lung Cancer	5	8.1
Mesothelioma	4	6.5
Genitourinary Cancers	2	3.2
Laryngeal Cancer	2	3.2
Osteosarcoma	2	3.2

Table 2. Success Rates of Utilized Pleurodesis Agents

Agent	No. of Successful Cases	No. of Unsuccessful Cases	Success Rate
Talc	45	4	91.1%
Tetracycline	9	3	66%
Bleomycine	6	2	66%
Total	60	9	85%

Table 3. Diagnostic and Therapeutic Interventions in Cases with Malignant Pleural Effusions

Groups	Diagnostic and Therapeutic Interventions
In MPE Cases with Previously Diagosed Malignancies	Diagnosis was established cytologically with thoracentesis in 12 cases (19.6%) and VATS+pleurodesis+mechanical pleural abrasion were performed in these cases. Diagnosis was also confirmed by specimen examination.
	Diagnosis was established through VATS+ pleurectomy in 14 cases (22.9%) and VATS+pleurectomy+pleurodesis were performed in these cases.
	In 15 cases (24.5%) VATS+ pleural biopsy + pleurodesis +mechanical abrasion were performed.
In MPE Cases with No Previously Established Malignancy Diagnosis	In 6 cases (9.8%), VATS+ pulmonary wedge biopsy +pleurodesis were performed and the diagnosis was reported as lymphoma.
	In 3 cases (4.9%), VATS+pulmonary biopsy+pleurectomy + pleurodesis were performed. The pathological diagnosis was reported as small cell ca.
	In 8 cases (13.1%) VATS+pulmonary biopsy +pleurectomy+pleurodesis were performed. The pathology report was non-small cell ca.
	In 3 cases (4.9%) VATS+ pleurectomy was performed. Diagnosis was reported as mesothelioma. In 2 of the cases, VATS+ pleurectomy+pleurodesis were performed while pleuro-pneumonectomy was applied in 1 patient who was regarded as operable.

pulmonary parenchyme and to provide pleurodesis. In 2 patients, regression of air leak was observed and chemical pleurodesis was provided under sedation and local anesthesia.

Respiratory failure developed in one patient due to the administered chemical agent (liquid tetracycline). This patient recovered following 3 days of mechanical ventilation treatment.

In 41 of the 45 patients (91.1%) in whom talc pleurodesis was performed, expansion developed and no relapse was observed. Relapse was seen in the remaining 4 patients. No further intervention was planned in these patiens due to disturbance of the general health; pleurocan was inserted and a conservative treatment approach was implemented with repetitive thoracentesis administrations. No relapse was seen in 6 of the 9 patients (66%) in whom tetracycline was administered, while in 4 of the 6 patients in whom chemical pleurodesis was performed by belomycine (66%), full expansion was observed and no relapse was seen (Table 2).

Side effects due to chemical pleurodesis included pain (especially in all of our patients in whom tetracycline was used), fever, respiratory distress and nausea.

The mean duration of drainage in cases in whom pleurodesis was performed by VATS was determined as 3.8 days. This duration was 2.5 days at minimum and 8 days at maximum. Patient follow-up varied between 1 month and 38 months. The mean duration of follow-up was 6.3± 3.8 and the median survival was 5.3 months. One patient who had been diagnosed with mesothelioma and treated with pleuro-pneumonectomy, was followed-up regularly for 38 months. Taking into consideration the survival durations, survival was longest in breast cancer patients with pleural effusions (mean 7.5 months), while this duration was 3.5 months in patients with lung cancer (Table 3).

Discussion

Currently, use of VATS is preferred based on the fact that it enables implementation of biopsy from the pleura and lungs easily and it is used as a means of diagnosis and treatment (Hazelrigg et al., 1993). It was shown that VATS is 89% sensitive in pulmonary and pleural diseases and it is 100% indicated in morphological diagnosis (Ginsberg, 1987). Complication rates were determined as 5-10% in all cases. This method can be safely preferred in elderly patients with restricted respiratory functions and in cases with comorbid diseases (Miller, 1993; Shennib et al., 1993). It leads to less surgical trauma. Other advantages of this procedure are protection of pulmonary functions and decreased requirement for postoperative analgesic.

Classically in MPE cases, a relapse in fluid accumulation is seen in 80% of the patients during the month following the tube thoracostomy intervention (Johnson, 1985). Therefore, obliterating procedures in the pleural cavity should be performed. The most successful interventions to prevent relapse of pleural fluid are drainage with VATS, pleurectomy and pleurodesis (Johnson, 1985; Canto et al., 1983). Through VATS applications, pleural surfaces (diaphragmatic, mediastinal pleura, visceral pleura, etc.) are visualized directly and hence, satisfactory specimens can be obtained for pathology and a solid opinion is formed about the origin of the tumor (Boutin, 1981).

Survival varies between 2-12 months in patients with MPE (Antunes and Neville, 2000; Chernow and Sahn, 1977). Symptoms such as severe dyspnea, pain and cough considerably disrupt the quality of life in these patients. This dramatic condition should be treated and patients should be relieved by supportive measures. This comfort may easily be realized through VATS in suitable cases. One of the main advantages of VATS is that it is valuable, both in terms of diagnosis and in terms of treatment. All

patients who had presented to our department no previous diagnosis, the diagnosis was established by VATS. In their series of 69 cases in whom VATS was performed for diagnostic and palliative treatment purposes, Yim et al. otained an 87% rate of specific diagnosis (Yim et al., 1996). Again, Yim et al. indicated the importance of VATS in differentiating mesothelioma and undifferentiated adenocarcinomas of the pleura.

Similarly in our series, the most frequent cause of MPE was lung cancer. On the other hand, due to the endemic presence of upper gastrointestinal system cancers (oesophagus and gastric cancers) in our region, we observed that these patients were followed up for lung cancer as a cause of MPE. The third most frequent cause of MPE was breast cancer and these patients had the best survival.

Another advantage of VATS in MPE cases is the decrease in the rate of pulmonary oedema which may develop in patients with massive effusion after tube thoracostomy. In VATS-applied cases, compression of the lungs due to iatrogenic pneumothorax which develops during insertion of the thoracoscope, prevents pulmonary oedema to a large extent (Brandth et al., 1985).

In MPE patients, talc can be insufflated into all pleural surfaces by thoracostomy and currently, it is the best conservative pleurodesis agent. At the same time, this agent is shown as the most effective agent in lymphomatous chylothorax cases (Kennedy and Sahn, 1994; Mares and Mathur, 1997; Rodriguez-Panadero and Antony, 1997). In a trial conducted by Walker-Renard et al., the success rate was 93% with talc, 68% with tetracycline and 54% with bleomycine (Walker-Renard et al., 1994). In our trial, the success rate was 91.1% with talc, while it was 66% with tetracycline and bleomycine.

In cases in whom pleurodesis was performed, symptoms like pain, fever, dyspnea and ARDS were reported in the literature. On the other hand, we believe that especially, ARDS develops due to utilization of high dose talc. We used 3 gr of talc in our series. The results were effective and no mortal complication was observed. Interestingly in one patient, acute respiratory failure developed following administration of tetracycline. This patient recovered after 3 days of respiratory support. The most frequent side effects were pain, fever and transient dyspnea attacks.

In a trial conducted by Bernard et al., thoracotomy was performed in 23% of 70 cases due to the trapped lung; in these patients, the postoperative complication rate was 69% while this rate was determined as 24% in cases in whom thoracoscopy was performed (Bernard et al., 2002). In our trial, we did not observe a major complication in thoracotomy cases.

In the trial performed by Boutin et al., pleural biopsy and cytology sampling was performed in all patients 1 day prior to thoracoscopy; the diagnosis was established at a rate of 41% through cytology and pleural biopsy while this rate was 87% with VATS. In our trial, the definite (pathological) diagnosis was established by VATS in 20 patients without a pre-diagnosis.

In conclusion, the presence of MPE is indicative of a poor prognosis. In these cases, especially in patients without a definite diagnosis, VATS is an effective diagnostic and therapeutic modality, provided that the procedure can be tolerated by patients. Talc powdering with VATS is a safe and economical procedure exhibiting a low morbidity rate.

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